



SAFETY AUDIT OF EXISTING ROADS

*Draft Procedures
February 1996*

Report No. 95/463S

SAFETY AUDIT PROCEDURES FOR EXISTING ROADS

Draft Procedures

**February 1996
Transit New Zealand**

PREFACE

This is a draft report

At its March 1996 meeting, the TNZ Authority received a report entitled "Safety Audit of Existing Roads Review of Process Development and Initial Implementation " (Review and Audit Division Report 95/434S Refer Authority submission 96/3/2247) One of the recommendations adopted by the Authority was

"That the Authority approves the publication of the procedures in draft form for use and comment by road controlling authorities "

The main purpose of developing these procedures is to provide TNZ's Safety Audit Manager with a tool to be used, amongst others, for assessing the efficient use of TNZ funds in respect of road safety The tool may benefit road controlling authorities for use as a means of self auditing

Work started in 94/95 on the development of procedures for the safety audit of existing roads. The following steps have been taken

- Review of current practices in New Zealand and overseas
- Demonstration of procedures by two Australian safety auditors
- Development of draft procedures for New Zealand conditions
- Four pilot audits using these draft procedures
- Revision of draft procedures
- Three further "real" audits using the revised procedures
- A further revision of the draft procedures

Review and Audit Division Report 95/434S "Safety Audit of Existing Roads Review of Process Development and Initial Implementation " describes this work in more detail A copy of this report is available on request from the address below

These draft procedures have been prepared by John Hannah of Beca Carter Hollings and Ferner, Tauranga with assistance from Colin Brodie of Works Consultancy Services, Hamilton Members of the audit teams mentioned above also provided useful comment on the procedures as they were developed.

Road Controlling Authorities are encouraged to try these draft procedures to audit a sample of their roads If anyone has any ideas on how to improve the efficiency and effectiveness of these draft procedures, he/she is invited to write directly to

Ian Appleton, Safety Audit Manager, Transit New Zealand, P O Box 5084, Wellington

Work is planned to develop these procedures further

SAFETY AUDIT PROCEDURES FOR EXISTING ROADS

Draft Procedures

Prepared for

TRANSIT NEW ZEALAND

By

BECA CARTER HOLLINGS & FERNER LTD

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SAFETY AUDIT OF EXISTING ROADS

GENERAL PROCEDURAL GUIDELINES

INTRODUCTION

Safety Auditing of projects was introduced by Transit New Zealand (TNZ) in 1993 and is continuing to be used to ensure safety aspects of projects are addressed in the best possible way

Now that this process is established it is recognised that there still remains very large sections of the roading network for which there is no recognised process to review and monitor the provision of traffic services

Safety Auditing of Existing Roads is being practiced by both New South Wales (RTA) and Queensland (Queensland Transport) in Australia. These procedures have been adapted from the RTA's guidelines to suit New Zealand conditions. Whilst the procedures for Rural Roads are now proven there is still a need for further development for the urban situation

To assist with both the development of this process and enable audit teams to monitor the acceptability of their recommendations feedback is important. Comments on the contents and format of the report as well as the overall benefits of the process are encouraged

These procedures are DRAFT for use on audits currently being undertaken. Ongoing experience will result in further modification and upgrading. Any suggestions for improvement will be gratefully received by Dr Ian Appleton, Safety and Audit Manager, TNZ or Mr John Hannah, Beca Carter Hollings & Ferner Ltd, Tauranga

OBJECTIVES

The objectives of safety audit are .

- identify potential safety problems for road users and others, and
- to ensure that measures to eliminate or reduce the problems are considered fully

Safety audit will .

- minimise the risk and severity of accidents that may be attributed to the existing road conditions
- reduce the whole life operating costs of road
- improve the awareness of safe maintenance practices
- the TNZ statement of purpose is to build and MAINTAIN safe roads

DEFINITION

Safety auditing is a formalised process to.

- identify potential safety problems for road users and others, and
- ensure that measures to eliminate or reduce the problems are considered fully

A safety problem is defined as a feature which has been identified from a road user's perspective which gives a misleading or confusing message or is in itself a hazard

THE EXISTING ROAD AUDIT PROCESS

1. INTRODUCTION

These procedures are designed for road safety audit where long lengths of existing roads are to be audited as well as closely developed urban areas

Where existing road audits are being conducted in complex urban environments the urban guidelines should be followed

2. RURAL ROADS

As a guide and dependent on the complexity a length, between 70 - 110 kms of road can be audited in one day including a night time inspection

Having decided upon the total road section to be audited it should be divided into smaller sub sections of between 13 - 20 kms In the case of State highways this will be route station lengths whilst on local roads it will be between intersections and/or total road lengths (Note changes in road function or volumes should also be used as section breaks)

3. URBAN ROADS

For audits of urban areas it is recommended that random samples of the Arterial and Principal roads be chosen for audit along with a sample of the local road network

4. AUDIT TEAM

The composition of the Audit team should generally be in keeping with that set out in TNZ's Safety Audit Policy and Procedures Manual (August 1993) and note the following

- The minimum team should be 3 people
- Two team members including the team leader should not be regular users of the subject roads or involved with their management
- Additional members may be included representing the Road Controlling Authority and or the Network Maintenance Consultant

5. TEAM TRANSPORT AND SAFETY

The vehicle used for the audit the be fitted with the following

- Tripmeter capable of "freeze", "step" and preferably reverse counting operation
- Side thrust gauge
- Hazard and rotating yellow lights
- Tapes and measuring wheel

All team members must wear Reflectorised Jerkins when undertaking inspections out of the vehicle

6. INSPECTION FORMAT

(a) Opening Meeting

The audit team should commence with an opening meeting with a representative of the road controlling authority and their network consultant. This meeting is to describe the procedures and obtain background information

(b) Inspection Programme

Audit inspections should be limited to a maximum of 3 days to ensure a good level of concentration is maintained

A proven format is as follows

Day 1	<ul style="list-style-type: none">• Opening meeting backgrounding team and road controlling authority members on the process• Review first day's audit inspection schedule• Undertake audit both day and night
Day 2	<ul style="list-style-type: none">• Prepare first draft of first day's audit report• Review second day's audit inspection• Undertake audit both day and night• Prepare first draft of second day's audit report
Day 3	<ul style="list-style-type: none">• Review third day's audit inspection. Note this will only cover a small sample and not include a night inspection• Prepare first draft of third day's audit report• Closing meeting. Discuss with Network Manager the general impressions and general audit findings

(c) Pre-inspection

Prior to commencing the physical inspection the audit team should meet and be briefed on

- The day's programme
- Description of road being audited including
 - Function in the Network
 - Seasonal considerations
 - AADTs
 - Crash history and trends noting particular locations along the route (not a detailed Crash Study)
 - Agreement on the roles to be fulfilled by each team member
 - Agreement on who will draft the report
 - Agreement on who will take the photographs

(d) Inspections

Because of the need to undertake night inspections it is best if audits are scheduled over the winter months when there is no daylight saving

(i) Rural

- Each sub section of road should be driven in each direction at "normal" user speed with the team members completing the inspection check sheets (See Appendix 1)
- At the end of this both direction run the team should discuss any inappropriate standards or safety problems, agree in principle and inspect in detail if necessary on the outward trip to the beginning of the next sub-section At this stage the team should also decide which intersections should be inspected by driving into and out of the side roads
- Night inspections should be undertaken by drive overs in both directions at normal speed The recording of items is best completed with the use of a dictaphone recording with the data transcribed before the post inspection meeting (Refer Section (e)) This inspection should only record items not noted during the daytime inspection and should be transcribed prior to the team meeting on the next morning

(ii) Urban

For the sections of Arterial & Principal Roads to be inspected it is recommended that these routes be driven at (normal) speed in each direction followed by a return inspection on a block by block basis checking for any items requiring detailed checking from the "Prompt" list Appendix II

The recording of these items will be made on a route progressive basis for summarisation by the team at the post inspection meeting

A separate check sheet for Signalised Intersections is also available Appendix II
A sample of signalised intersections should be inspected by driving through the intersection from each approach followed by an on foot inspection to check both pedestrian facilities and general traffic control phasing and queue arrangements

Inspections of the sample local road network should be undertaken by a drive through of the area noting similar aspects to those listed on the Urban Prompt sheet

(e) Post Inspection Meeting / Report Drafting

Following the completion of all of the inspections (preferably the morning following the night audit) the team shall meet and agree in draft format the issues to be recorded. Because of the large volume of data involved it is important that this be completed for each days inspections before commencing further inspections. Failure to do this could lead to confusion between the various sites inspected

(f) Report Format

The report format shall be similar to that set out in TNZ's Safety Audit Policy and procedure Manual (August 1993) modified as follows

- (i) A general description of the route including traffic volumes, geographic features, function, accident trends and inspection format
- (ii) A section dealing with the application of Design standards firstly in general terms followed by site specific items
- (iii) A section dealing with Maintenance standards firstly in general terms followed by site specific items
- (iv) Inappropriate standards or safety problems will be reported as per the safety audit procedures (Safety Audit Policy and Procedures August 1993) but instead of using the "problem" with or without **** each problem will be assigned a risk level as set out in the attached Appendix III

The total report can be divided into separate sections for each route or a combined (total authority network) report. The format should be discussed with the network manager. The "by route" type report is useful to pass directly to the network consultant to implement recommendations on a route / route basis. The "Network" type is useful for the road controlling authority to review its overall level of traffic services and road safety. This can then be used to develop medium and long term strategies.

(g) Exit Meeting

At the conclusion of deliberations it is recommended that verbal report be made to the Asset Manager prior to the team dispersing

(1) Reporting Process

The completed report should be processed in a similar way to all Review and Audit Reports eg

- Draft Report to Asset Manager
- Asset Manager to comment on
 - factual errors
 - omissions
 - disagreement with any opinions expressed
- Final report to Asset Manager

Note This process may be varied if the report is being undertaken directly for the road controlling authority

APPENDIX I
SAFETY AUDITING OF EXISTING ROADS
INSPECTION PROCEDURES
RURAL ROADS

These procedures are designed to be able to be used for both the 6 monthly safety management strategy (SMS) maintenance orientated inspections as well as less frequent (3 - 5 yearly) audits by independent personnel. The six monthly inspections will focus strongly on the maintenance faults and note any obvious inappropriate standards or safety problems. The audits (3 - 5 yearly) will focus on the inappropriate standards or safety problems and note as many maintenance faults as possible. These Audits will give an independent global overview based on a sample of the network.

Inspection Check Sheets

1 Maintenance Deficiencies - Sheet 1

The various maintenance faults are to be noted with / in the appropriate box correlating with the running distance and fault. This can be then noted \ on the reverse direction drive-over. The spare columns can be used for any other maintenance items.

The recording is not designed to provide outputs detailing faults which can be passed directly to the maintenance contractor but should be used to prompt a more detailed inspection to schedule specific maintenance activities.

These sheets should be completed during the (normal) user speed drive over.

2 Inappropriate Standards or Safety Problems - Sheet 2

Before commencing the inspection particularly for an audit (3 - 5 yearly) the team should familiarise itself with the desirable standards for the section. During the "normal speed" drive over in each direction, the item and any comment should be noted against the running distance. These items can be examined if necessary by the team on the second outward trip and the comments expanded to a separate sheet.

Whilst these sheets may be partially completed during the (normal) user speed driver over they should be completed more fully during the return detailed inspection.

SAFETY AUDIT OF EXISTING ROADS
INSPECTION CHECK SHEET 1 - MAINTENANCE ITEMS

State Highway
(or road name)

Start Position
(RS or side road)

Finish Position
(RS or side road)

AADT

Mid Block Injury
Accident rate

Weather

Date / / Completed By

Running Distance kms	0 00	0 50	1 00	1 50	2 00	2 50	3 00	3 50	4 00	4 50	5 00	COMMENTS
Surface Condition/Ride												
Shoulder Condition/Edge Break												
Side Slopes/Clear Zone/Water Table												
Vegetation (obstructing visibility & signs)												
Guardrails (exist) (requiring maintenance)												
Drainage Features (culverts etc)												
Centreline & Edge lines & RRPM's												
Marker Posts												
Curve Warning/Chevrons												
Other Warning/Advisory												
Intersection Marking & Signs												
Destination Signs												
Regulatory/Side Road Control												

SAFETY AUDIT OF EXISTING ROADS
INSPECTION CHECK SHEET 1 - MAINTENANCE ITEMS

State Highway
(or road name)

Start Position
(RS or side road)

Finish Position
(RS or side road)

AADT
Mtd Block Injury
Accident rate

Weather

Date / / Completed By

Running Distance kms	5 50	6 00	6 50	7 00	7 50	8 00	8 50	9 00	9 50	10 0	COMMENTS
Surface Condition/Ride											
Shoulder Condition/Edge Break											
Side Slopes/Clear Zone/Water Table											
Vegetation (obstructing visibility & signs)											
Guardrails (exist) (requiring maintenance)											
Drainage Features (culverts etc)											
Centreline & Edge lines & RRPM's											
Marker Posts											
Curve Warning/Chevrons											
Other Warning/Advisory											
Intersection Marking & Signs											
Destination Signs											
Regulatory/Side Road Control											

SAFETY AUDIT OF EXISTING ROADS
INSPECTION CHECK SHEET 1 - MAINTENANCE ITEMS

State Highway
(or road name)

Start Position
(RS or side road)

Finish Position
(RS or side road)

AADT
Mid Block Injury
Accident rate

Weather

Date / /

Completed By

Running Distance kms	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	COMMENTS
Surface Condition/Ride											
Shoulder Condition/Edge Break											
Side Slopes/Clear Zone/Water Table											
Vegetation (obstructing visibility & signs)											
Guardrails (exist) (requiring maintenance)											
Drainage Features (culverts etc)											
Centreline & Edge lines & RRPM's											
Marker Posts											
Curve Warning/Chevrons											
Other Warning/Advisory											
Intersection Marking & Signs											
Destination Signs											
Regulatory/Side Road Control											

State Highway (or road name)	Start Position (RS or side road)	Finish Position (RS or side road)	AADT	Mid Block Injury	Accident rate
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SAFETY AUDITING OF EXISTING ROADS

INSPECTION CHECK SHEET 2 STANDARDS AND PROBLEMS

State Highway (or Road name)	Start Position RS or side road)	Finish Position (RS or side road)	AADT Mid block injury Accident Rate
---------------------------------	------------------------------------	--------------------------------------	-------------------------------------------

Weather

Date

Completed by

Alignment Consistency

Consistency of Pavement Width (Lane and Shoulders)

Delineation (Warning, Information & Destination Signs, Edge Marker Posts etc)

Level of Service (Overtaking opportunities, passing lanes and access control)

Road Side Hazards (Clear Zones, Drains, Poles, Advertising Signs etc) (Guard railing required)

Intersections (Form, Conspicuity, Control, Markings, Sight Distance)

APPENDIX II
SAFETY AUDITING OF EXISTING ROADS
INSPECTION PROCEDURES

URBAN ROADS

These procedures are designed to be a prompt for both frequent maintenance (6 monthly) and audit (3-5 yearly) inspections

As described in section 6 of the guidelines the total section of Urban road should be driven in both directions at normal speed

This is then followed by a detailed block by block inspection using the attached prompt sheet It will probably be necessary for the team to stop in each “block” and complete the detailed inspection on foot (Wearing Jerkins of course)

A separate prompt sheet for traffic signal is also attached The team should, following the drive over, decide which set or sets of signals to inspect in detail

At all times in the “urban” sector remember that there are many road users (through vehicles, parking vehicles, parked vehicles, turning vehicles, vehicles entering or exiting property’s, cyclists, pedestrians both elderly and young), and give thought to their needs and safety

Safety Audit Existing Roads

Urban Prompt List

Local Authority

Road Name

Section

Date / /

Weather

Completed by

Features		Standards	Comments
Roadmarkings		Condition	
		Lanes marking	
		Edgelines	
		Flush Median	
		RRPM's	
Side Road Control & Intersections		Visibility (Both entering and exiting)	
		Are the controls appropriate	
		Are signs and markings correct and visible	
Signs		Street Name	
		Directional / Information	
		Advertising	
Pedestrian		Crossings	
		Pedestrian areas	
		Refuges	
Cyclists		Provision for	
		Manoeuvring space	
		Have major generators adequate facilities	
		Appropriate	
		Adequate	
		Conflict LP Sodium with Signals	
Speed Control		Misleading	
Lighting			

SAFETY AUDIT EXISTING ROADS TRAFFIC SIGNAL AUDIT PROMPT LIST

Location:..... **Date:**.....
Weather:..... **Completed By:**.....

This list of prompts is to assist the team to identify the general compliance of the installation with current standards and the surrounding network. It is not designed to be a detailed inspection but to give a general overview of the operation and compliance with existing standards.

GEOMETRIC LAYOUT

- Sight Distances
- Intervisibility

THE SITE

- The landuse
- The speed limit/environment

THE NETWORK

- Co-ordinated?
- Nearby signals - consistency?

THE SIGNALS

- (a) Operation, Waste Time or Short Phasing?
 - Pedestrians, catered for? Should they?
 - Cycles
 - Accidents
- (b) Hardware - Compliance with standards
 - Lanterns
 - Poles
 - Backing Boards
- (c) Approaches
 - Markings
 - Pavement Condition
 - Signs
 - Footpaths and pram crossings

APPENDIX III

SAFETY AUDITING EXISTING ROADS

**RISK LEVEL ASSESSMENT FOR
INAPPROPRIATE STANDARDS OR SAFETY PROBLEMS**

To provide some initial guidance for prioritising feasibility investigations into each item identified the following definitions and matrix is to be agreed and assigned by the team

This is not a scientific system but simply a judgement call by the auditors and may be amended by detailed analysis using BCs at a later stage of investigation. In complex situations consideration should be given to using more detailed analysis of hazard probability and severity. This may involve comparative analysis of other like situations.

The audit team should use the following process to determine the priority of issues identified as inappropriate standards or safety problems as well as outstanding maintenance requirements

Step I Determine the level of "Hazard Probability" from Table 1

Step II Determine the category of the "Hazard Severity" from Table 2

Step III Determine Risk Level from Table 3

Table 1 : Hazard Probability

Probability	Description
Frequent	Likely to occur frequently (once / year)
Probable	Likely to occur more than once (once / 5 years)
Occasional	Likely to occur at some time (once / 10 years)
Remote	Will rarely occur (7 - 10 years)
Improbable	Unlikely that the occurrence may never be experienced

Table 2 : Hazard Severity

Category	Description
Catastrophic	Will cause multiple fatalities
Critical	Likely to cause a fatality
Major	Could possibly cause a fatality
Minor	could cause serious injury
Negligible	Not likely to cause serious injury

Table 3 : Risk Level

Severity	Probability				
	Frequent	Probable	Occasional	Remote	Improbable
Catastrophic	EXTREME RISK				
Critical		HIGH RISK			
Major			MEDIUM RISK		
Minor				LOW RISK	
Negligible					